a.

PATENT ABSTRACTS OF JAPAN

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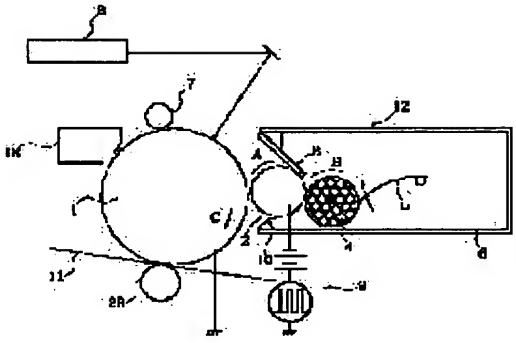
(54) DEVELOPING METHOD

(57)Abstract:
PURPOSE: To attain a clear image without fogging while keeping sufficient image density by specifying relation among the circumferential speed of a developing sleeve, toner density and toner sticking quantity.
CONSTITUTION: When it is assumed that the circumferential speed of an electrostatic latent image carrier 1 is Vd(cm/s), the circumferential speed of the developing sleeve 2 is Vs(cm/s), the toner density is ρ (g/cm3), and the toner sticking quantity on the developing sleeve 2 in M(g/cm2), either of following conditions is satisfied: $0.2 \times 10-3 \leq M/\rho < 0.4 \times 10-3$(cm), and $(M/\rho).(Vs/Vd) \geq 0.5 \times 10-3$(cm). Or $0.4 \times 10-3 < M/\rho < 0.6 \times 10-3$(cm), and $(M/\rho).(Vs/Vd) \geq 0.7 \times 10-3$. Or $0.6 \times 10-3 \leq M/\rho < 0.7 \times 10-3$(cm), and $(M/\rho).(Vs/Vd) \geq 0.8 \times 10-3$(cm).



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JAPANESE [JP,06-194943,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

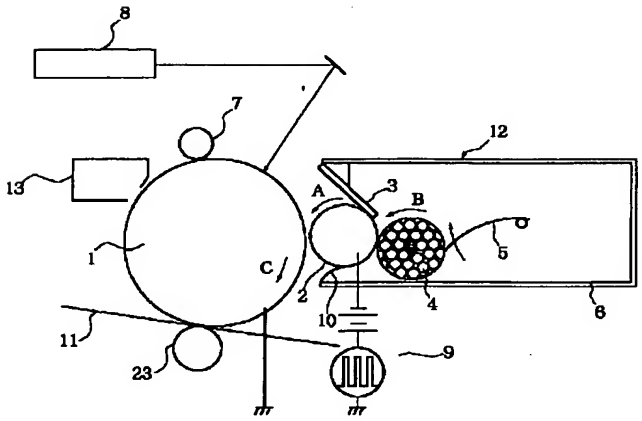
[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] In the development method of having the following, going by the aforementioned gap, making the toner in the toner thin layer formed in the aforementioned developing roller move onto an electrostatic latent-image support, and developing an electrostatic latent image When setting [the peripheral velocity of the aforementioned electrostatic latent-image support / the peripheral velocity of Vd (cm/s) and the aforementioned developing roller] toner coating weight on rho (g/cm3) and the aforementioned developing roller to M (g/cm2) for the density of Vs (cm/s) and a toner, The development method characterized by satisfying the formula of the following 1, or 2 and 3. The developing roller which kept the gap in the electrostatic latent-image support, and has been arranged Toner thin layer means forming which forms a toner thin layer in the front face of this developing roller
1.0.2x10-3 <= M/rho <0.4x10-3 (cm)
(M/rho) -(Vs/Vd) >=0.5x10-3 (cm)
2.0.4x10-3 <= M/rho <0.6x10-3 (cm)
(M/rho) -(Vs/Vd) >=0.7x10-3 (cm)
3.0.6x10-3 <= M/rho <=0.7x10-3 (cm)
(M/rho) -(Vs/Vd) >=0.8x10-3 (cm)
[Claim 2] The binding resin of the aforementioned toner contains the polyester resin generated from the monomer constituent which contains the following component (a), (b), (c), and (d) at least as a principal component. The hydroxyl values of this polyester resin are 10-20, and weight average molecular weight is 13000-20000. The development method according to claim 1 characterized by for number average molecular weight being 5000-8000, and the ratios of weight-average-molecular-weight (Mw) / number average molecular weight (Mn) being 2-3.5. The divalent aromatic system acid component chosen from an isophthalic acid, a terephthalic acid, and its derivative (a) 25-35-mol% of the total amount of monomers (b) The trivalent aromatic system acid component chosen from trimellitic acid and its derivative 2 - four-mol% of the total amount of monomers (c) It is 45 - 60-mol% of the total amount of monomers about 12 - 18-mol% of the total amount of monomers, the formation of (d) propoxy or/, and the etherification diphenol component that ethoxylated in the divalent acid component chosen from a dodecenyl succinic acid, an octyl succinic acid, and its anhydride at least.

[Translation done.]

Drawing selection [Representative drawing]



[Translation done.]

JAPANESE [JP,06-194943,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the development method of developing an electrostatic latent image using the developer which does not contain the carrier particle in 2 component developer, and the so-called 1 component developer.
[0002]
[Description of the Prior Art] When using the 1 component developer (henceforth a toner) and developing an electrostatic latent image, a toner acquires the friction charge in which development of a latent image is possible by the developing roller or friction which it is with toner thickness specification-part material further.
[0003] As for the concentration of the record picture which, on the other hand, imprints the toner image formed in the latent-image supporter to imprint material, and is acquired, 1.4 to 1.5 or more are desirable at optical density, and in order to obtain this picture concentration, it must make [many] the amount of the toner which moves onto an electrostatic latent-image support from a developing roller. Therefore, in order to obtain sufficient picture concentration conventionally, in the case of a magnetic toner, it is the toner coating weight on a developing roller Abbreviation 1.3x10-3 g/cm2 In the case of a nonmagnetic toner, it is abbreviation 0.8x10-3 g/cm2 above. It has set up above.
[0004]
[Problem(s) to be Solved by the Invention] However, the toner near the center of a toner layer having un-arranged [of polarity being opposite to regular polarity, or fully not being charged], although the toner a developing roller and near the toner thickness specification-part material can be enough rubbed against these members and will fully be regularly charged, if a toner layer is set up thickly as mentioned above.
[0005] Namely, if the force of electric field in which the toner which has not been charged regularly as mentioned above arrived at the development field, and was formed of development bias is received Since it flies towards the part in which the latent image on a photoconductor drum is not formed, and it becomes fogging and the toner whose amount of electrifications is not enough exists mostly, the toner of sufficient amount for the latent-image formation section on a photoconductor drum does not reach, but there is un-arranging [that development efficiency will fall].
[0006] this invention was made in view of the above-mentioned problem, and the place made into the purpose is to offer the developer which attains a clear picture without fogging, maintaining sufficient picture concentration.
[0007]
[Means for Solving the Problem] The development sleeve which this invention kept the gap in the electrostatic latent-image support, and has been arranged that the above-mentioned purpose should be attained, The toner thin layer means forming which forms a toner thin layer in

the front face of this development sleeve is provided. In the development method of going by the aforementioned gap, making the toner in the toner thin layer formed in the aforementioned development sleeve move onto an electrostatic latent-image support, and developing an electrostatic latent image When setting [the peripheral velocity of the aforementioned electrostatic latent-image support / the peripheral velocity of Vd (cm/s) and the aforementioned development sleeve] toner coating weight on rho (g/cm3) and the aforementioned development sleeve to M (g/cm2) for the density of Vs (cm/s) and a toner, It is the development method of satisfying the formula of the following 1, or 2 and 3.

[0008]

1.0.2x10-3 <= M/rho <0.4x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.5x10-3 (cm)

2.0.4x10-3 <= M/rho <0.6x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.7x10-3 (cm)

3.0.6x10-3 <= M/rho <=0.7x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.8x10-3 (cm)

[0009]

[Example] Drawing 1 is image formation equipment equipped with the developer 12 which used the nonmagnetic toner, and the front face of the electrophotography photoconductor drum 1 as an electrostatic latent-image support which ** four times in the direction of arrow C with the primary electrification vessel 7 as a printing process is uniformly charged in negative polarity. Subsequently, picture exposure is performed by the aligner 8 which uses a laser beam as the light source based on image information, and a latent image is formed on a photoconductor drum 1. Next, this latent image is formed into a visible image by reversal development with a nonmagnetic toner with a development counter 12. The toner image on a photoconductor drum 1 is imprinted on the imprint material 11, and a transfer residual toner is cleaned with a cleaner 13. It is fixed to the imprint material 11 by which the toner image was imprinted by the non-illustrated fixing assembly, and it obtains a permanent image.

[0010] a development counter 12 -- the inside of a toner bottle 6 -- toner conveyance -- the application roller 4 rotates in the direction of arrow B, and applies the nonmagnetic toner as a 1 component developer stored in the toner bottle 6 on the development sleeve 2 so that it may have the application roller 4 for conveying a toner to about two conductive development sleeve as a member 5 and a developing roller rotated in the direction of arrow A and may have relative velocity to the development sleeve 2 It is more desirable for the application roller 4 to be sponge or to give knurling tool processing or brush-like processing, in order to make this application perform good.

[0011] The applied toner is regulated by predetermined thickness with the elastic blade 3. the member in which the elastic blade 3 has elasticity, such as polyurethane rubber, -- the member of the shape of a sheet, such as polyurethane rubber, is stuck on the member which has elasticity, such as a simple substance and phosphor bronze And the pressure welding of the blade 3 is elastically carried out to the sleeve 2.

[0012] Even regulation of ** toner thickness is thinner than the minimum gap (50-500 micrometers) between a drum 1 and a sleeve 2 in the development section which develops a latent image with a blade 3. Therefore, the so-called non-contact development is performed. That is, a toner flies from a sleeve 2 and adheres to the latent image of a drum 1.

[0013] In order to improve development efficiency, the oscillating bias voltage which superimposed alternating voltage on direct current voltage from the power supply 9 is impressed to a sleeve 2, and the oscillating electric field which the sense reverses by turns are formed in the development section of this.

[0014] A toner is charged in negative polarity mainly in friction with a sleeve 2, when rubbed by the sleeve 2 with a roller 4, and when passing the nip of a blade 3 and a sleeve 2.

[0015] The result of an experiment of this example in the development counter of the

above-mentioned composition is shown in Table 1. the ratio [as opposed to / in Table 1, a horizontal train is the amount M of toner support on the developer support after the toner regulation with an elastic blade (g/cm2), and / the peripheral velocity of an electrostatic latent-image support in a column] of the peripheral velocity of a development sleeve -- it is Vs/Vd, and in this experiment, the peripheral velocity of an electrostatic latent-image support is fixed to 6.0 cm/sec., and it carries out adjustable [only of the peripheral velocity of a development sleeve] When, as for the sign of front Naka, quality of image with optical density [in the paper] practically sufficient [1.5 or more and fogging] at 1% or less is obtained for "O", when, as for concentration, fogging is a little conspicuous at 1 - 2% sufficiently but, "x" of "**" is [concentration] the case where fogging is considerably conspicuous at 2% or more, sufficiently but. Or less in 1.5, picture concentration of "U" is thin or its concentration is the case where picture concentration becomes uneven.

[0016] **** -- it set, fogging was measured using the reflection density meter TC-6DS type by Tokyo Denshoku Co., Ltd., and the value computed from the following formulas was used (Reflection factor of the imprint object before image formation) - (reflection factor of the imprint ****** picture section after image formation) (%)

[0017]

[Table 1]

表　1

M (g/cm³) / Vs／Vd	0.1 × 10^{-3}	0.2 × 10^{-3}	0.3 × 10^{-3}	0.4 × 10^{-3}	0.5 × 10^{-3}	.6 × 10^{-3}	0.7 × 10^{-3}	0.8 × 10^{-3}	1.0 × 10^{-3}
0.8							ウ		
1.0						ウ	ウ	△	
1.2				ウ	ウ	ウ	○		
1.4				○	○	○			
1.6						○			
1.8		ウ	○	○		○	○	△	×
2.0									
2.2									
2.4									
2.6	ウ	○	○			○	△	×	
2.8									
3.0		○							

[0018] Since the density rho of the nonmagnetic toner used for this example is 1.0 g/cm3, if the value of Vd, Vs, rho, and M in a setup of "O" of front Naka is substituted for the following formulas, the relation of the following formulas will be materialized in all setup.

[0019]

1.0.2x10-3 <= M/rho <0.4x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.5x10-3 (cm)

2.0.4x10-3 <= M/rho <0.6x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.7x10-3 (cm)

3.0.6x10-3 <= M/rho <=0.7x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.8x10-3 (cm)

[0020] In addition, the density of a toner says the thing of the weight per unit volume in melting and the state where solidified and it considered as the solid material, on these specifications for

not a thing but the toner of a weight per unit volume of fine particles.
[0021] Next, the case where a magnetic toner is used is explained based on drawing 2 . Since the composition of the equipment except a development counter is the same as that of the image formation equipment of drawing 1 , explanation is omitted. The development counter has the container 17 which held magnetic 1 component developer 14 which does not contain a carrier particle, i.e., an insulating magnetism toner. By the nonmagnetic development sleeves 19 rotated in the direction of an arrow, such as aluminum and stainless steel, a toner is carried out from a container and conveyed by the development section 21. In the development section 21, minimum spacing was kept at 50-500 micrometers, and the electrophotography photoconductor drum 1 and the development sleeve 19 as an electrostatic latent-image support have countered. And in this development section 21, a toner is given to an electrostatic latent image and negatives are developed.
[0022] The thickness of the magnetic toner layer conveyed by the development section is regulated by the blade 16. Blades are the magnetic substance, such as iron, and have countered through the magnetic pole N1 and the development sleeve 19 of a magnet 15 by which quiescence arrangement was carried out into the development sleeve 19 in between. Therefore, the line of magnetic force from a magnetic pole N1 concentrates to a blade 16, and a magnetic curtain strong between a blade 16 and the development sleeve 19 is formed. On the development sleeve 19, the magnetic toner layer 22 thinner than the gap between a blade 16 and the development sleeve 19 is formed with this magnetic curtain.
[0023] By impressing oscillating bias voltage to a sleeve 19 from a power supply 9, the toner on a sleeve 19 is made to fly towards a drum 1, and adheres to a latent image.
[0024] A toner is charged mainly by friction with a sleeve 19.
[0025] The experimental result by the development counter of the above-mentioned composition is shown in Table 2. Since the density rho of the magnetic toner used for this example is 1.5 g/cm3, if the value of Vd, Vs, rho, and M in a setup of "O" of front Naka is substituted for the above-mentioned formula like the case of a nonmagnetic 1 component toner, the relation of the above-mentioned formula will be materialized in all setup.
[0026]
[Table 2]

表　2

Vs／Vd ＼ M (g/cm²)	0.2 × 10^{-8}	0.3 × 10^{-8}	0.4 × 10^{-8}	0.5 × 10^{-8}	0.6 × 10^{-8}	0.7 × 10^{-8}	0.8 × 10^{-8}	0.9 × 10^{-8}	1.0 × 10^{-8}	1.1 × 10^{-8}	1.2 × 10^{-8}	1.3 × 10^{-8}	1.4 × 10^{-8}	1.5 × 10^{-8}
0.8										ウ				
1.0									ウ					
1.2									○					
1.4						ウ	○	○						
1.6					ウ									
1.8			ウ	○	○			○	○	△	×			×
2.0														
2.2														
2.4														
2.6	ウ	○			○				○	×				
2.8														
3.0	ウ	○												

[0027] By the way, in order to fully electrify a toner, it is desirable to use the fluid outstanding toner.

[0028] By using a toner excellent in the fluidity, while being able to attain the formation of a uniform toner coat layer and friction charge grant on a development sleeve, in a development field, toner flight is performed good according to impression of development bias, and-izing can be carried out [a visible image] as a toner image faithful to a latent image, without forming the state where the toner particle condensed to the latent image on a photoconductor drum by the ability of formation of a uniform powder cloud to be performed.

[0029] The fluidity index in drawing 3 contains a resin and a coloring matter at least, it adheres to fluid improvement material strongly uniformly, so that this numeric value is small, and it is the index of how much fluid improvement material has adhered in homogeneity to the classification article front face which is 5-12 micrometers of volume mean particle diameters strongly, and its

fluidity improves.
[0030] Conventionally, the measuring method of a toner fluidity index took the following methods with the well-known powder circuit tester ([by Hosokawa Micron CORP.] PT-D type), and measured. Measurement environment is set to 23 degrees C and 60%RH.
[0031] After leaving a toner under measurement environment for 12 hours, weighing capacity of the 5.0g is carried out correctly. The sieve of 100 meshes (150 micrometers of openings), 200 meshes (75 micrometers of openings), and 400 meshes (38 micrometers of openings) is set to a shake table in piles from a top.
[0032] The 5.0g toner which carried out weighing capacity correctly is used calmly (on 100 meshes), and it is made to vibrate for 15 seconds with the back of 2, and the amplitude of 1mm.
[0033] The amount of toners which remained on each sieve calmly is weighed precisely.
[0034] (Amount (gof toners) which remained on 100 meshes) / 5x100 .... a(amount of toners which remained on 200 meshes (g))/5x100x3/5 .. b(amount of toners which remained on 400 meshes (g))/5x100x1/5 .. c fluidity-index (%) =a+b+c [0035] In drawing 1 , as for a setup of a development counter, and Vs, Vd and M, concentration is obtained by the experiment of drawing 3 1.5 or more, using a nonmagnetic toner, and fogging is also 1% or less.
[0036] A relation like drawing 3 is obtained from the value of the fluidity index of the toner obtained from the above-mentioned formula, and the value of fogging on a transfer paper.
[0037] Scattering of a toner becomes remarkable in using the nonmagnetic toner which cannot regulate the toner by the MAG since formation of a powder cloud is performed very actively when a toner arrives at [a fluidity index] a development field in 2% or less of field in drawing 3 especially.
[0038] If a fluidity index becomes high, the movement of a toner becomes bad at the time of the friction charge grant by the specification part, when the number of times of contact with a blade or a development sleeve becomes fewer, a toner will stop fully charging and a reversal toner will increase.
[0039] If a fluidity index exceeds 20% as shown in drawing 3 , the value of fogging will exceed 3%. For this reason, in order to acquire the high-definition picture in which fogging is not conspicuous, as for the fluidity index of the toner to be used, it is desirable that it is 20% or less.
[0040] Since it is desirable for the value of fogging in a monochrome image to be 1% or less in order to stop the total amount of fogging in the color picture formation equipment on which many especially toner images are put, the fluidity index of a toner becomes 10% or less.
[0041] However, when the fluidity index mentioned above uses for the developer which showed 20% or less of toner to drawing 1 , A toner tends to flow into the crevice between between easily. the fluidity of a toner -- each composition in the good hatchet development counter 12 -- a member -- if it is in the developer by which the big crevice was especially formed between application roller 4 edge and the toner bottle 6 wall section, without the toner which entered the crevice is supplied to the development sleeve 2 -- conveyance -- since a toner is supplied from a member 5, toner condensation will be caused
[0042] When the peripheral-speed ratio of a photoconductor drum and a development sleeve is still higher, in order to rotate at high speed, while the stress which joins a toner increases, in order to carry out the temperature rise of the application roller 4 and the development sleeve 2, the condensed toner has a possibility of carrying out ****** solidification gradually, under hot environments (room temperature of 30 degrees C or more).
[0043] As for the glass transition temperature ("Tg" is called hereafter) of this to a toner, it is desirable that it is 60 degrees C or more. Moreover, since each color toner needs to carry out ****** color mixture uniformly at the time of fixing in order to obtain a good color reproduction, when forming a color picture for cyanogen, a Magenta, yellow, and the toner image of four colors of black in piles especially and it is necessary to use the low toner of toner softening temperature, as for Tg, it is desirable that it is 67 degrees C or less.
[0044] Measurement of Tg was measured using a differential-thermal-analysis measuring device

(DSC measuring device) and DSC-7 (PerkinElmer, Inc. make). Weighing capacity of the 5-20mg of the measurement samples is carried out precisely [it is desirable and] 10mg. This is put in into an aluminum pan, and using the empty aluminum pan as a reference, the next operation is performed in order to eliminate all histories first. It is made to go up by 10 degrees C/min from a room temperature to 200 degrees C under N2 atmosphere, and maintains for 10 minutes at 200 degrees C. It quenches after that, lowers to 10 degrees C, and maintains for 10 minutes at 10 degrees C. Then, it goes up to 200 degrees C by 10 degrees C of programming rates, and min. The endothermic peak of the main peak in the range of 40-100-degree C temperature is acquired by this programming rate. Let the intersection of the middle line of the base line of the back before an endothermic peak comes out at this time, and a differential heat curve be the glass transition temperature Tg in this invention (refer to drawing 4).

[0045] By setting [in the case of monochrome image formation] up the fluidity index of a toner to 2 - 10% 2 to 20% like the above in color picture formation Furthermore, when becoming possible to prevent fogging certainly and forming a color picture using a nonmagnetic 1 component toner, by making Tg of a toner into 67 degrees C from 60 degrees C, there is no possibility that toner weld may occur under hot environments, and it becomes possible to also attain sufficient color-reproduction nature.

[0046] When the toner indicated by Japanese Patent Application No. No. 152219 [four to] in this example was used, as described above, high-definition picture also with the sufficient color reproduction at the time of fixing without fogging was acquired, and toner weld was not generated under hot environments (30 degrees C).

[0047] The binding resin of a toner with the toner which **(ed) and was indicated by the above-mentioned application The following component (a), The polyester resin generated from the monomer constituent which contains (b), (c), and (d) at least is contained as a principal component. It is the toner characterized by for the hydroxyl values of this polyester resin being 10-20, for weight average molecular weight being 13000-20000, for number average molecular weight being 5000-8000, and the ratios of weight-average-molecular-weight (Mw) / number average molecular weight (Mn) being 2-3.5.

[0048] The divalent aromatic system acid component chosen from an isophthalic acid, a terephthalic acid, and its derivative (a) 25-35-mol% of the total amount of monomers (b) The trivalent aromatic system acid component chosen from trimellitic acid and its derivative 2 - four-mol% of the total amount of monomers (c) It is 45 - 60-mol% of the total amount of monomers about 12 - 18-mol% of the total amount of monomers, the formation of (d) propoxy or/, and the etherification diphenol component that ethoxylated in the divalent acid component chosen from a dodecenyl succinic acid, an octyl succinic acid, and its anhydride at least.

[0049] Drawing 5 explains the following example. In addition, what carries out the same composition operation as the example of drawing 1 attaches the same sign, and omits explanation.

[0050] from the member in which the elastic blade 3 has elasticity, such as polyurethane rubber and phosphor bronze, in drawing 5 -- changing -- the electrification polarity of a toner -- reversed polarity -- and the member 24 of the shape of a sheet which has the property in which it is charged strongly is stuck on the toner and the portion which ****

[0051] Although nylon, cellophane, etc. which show the property of just being charged strongly as a sheet member are used in order that the toner used for this example may show negative electrification nature, the point of opposite abrasiveness and environmental stability etc. to nylon is desirable.

[0052] The amount of electrifications of the toner under each environment in the case where the blade of only polyurethane rubber and the blade which stuck the nylon sheet on the surface of polyurethane rubber are used, and the relation of quality of image are shown in Table 3.

[0053] As for a setup of a development counter, and Vs, Vd and M, concentration is obtained by the experiment of Table 3 1.5 or more like the example of drawing 1 under 23 degrees C, and

50% environment of RH, using a nonmagnetic toner, and fogging is also 1% or less.
[0054] In performing this comparison examination, in the case of the blade of only polyurethane rubber, compared with the blade which stuck the nylon sheet, the contact pressure to the development sleeve of a blade is highly set up so that both friction may become almost equal under the environment of ordinary temperature normal relative humidity.
[0055]
[Table 3]

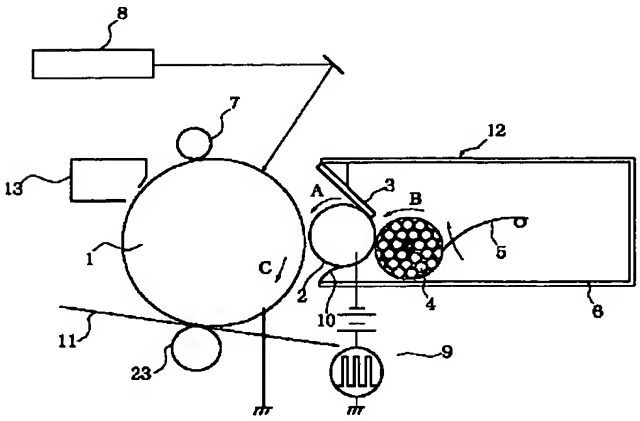
表 3

帯電量 (μC/g) ／ 画質	23℃ 50%R.H.	15℃ 10%R.H.	30℃ 80%R.H.
ウレタンゴムのみ	−15 ／ ○	−40 ／ 濃度不足	−6 ／ カブリ多し
ナイロンシート貼り付け	−18 ／ ○	−20 ／ ○	−15 ／ ○

[0056] Only in the case of polyurethane rubber, since the set pressure of a blade is high under low-humidity/temperature environment, a toner carries out [a blade] a charge up too much, concentration runs short, and reversal fogging has occurred under a high-humidity/temperature environment, without the ability fully giving a friction charge to a toner so that clearly from Table 3. On the other hand, when the sheet of strong positive electrification nature is used for a blade, without being influenced by environment only from polyurethane rubber, it turns out that the friction charge is certainly given to the toner, and it turns out that fogging is not generated further, either.
[0057] If it is made a setup which satisfies picture concentration and fogging under the environment of ordinary temperature normal relative humidity like an example 1 by using the sheet which carries out triboelectrification to a blade at a toner and reversed polarity as explained above, it will become possible to be stabilized under the environment of low-humidity/temperature from under the environment of heat and high humidity, and to attain high definition.
[0058]
[Effect of the Invention] Fogging is not generated in order to attain the concentration of sufficient picture by the above explanation according to this invention, keeping the toner layer on a development sleeve thin so that clearly.

[Translation done.]

Drawing selection [Representative drawing]



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[Translation done.]

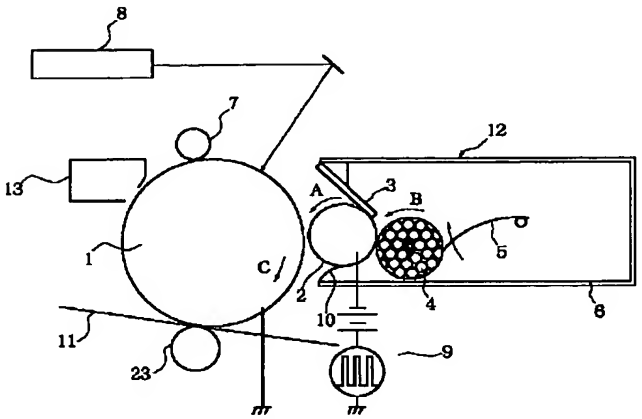
* NOTICES *

TECHNICAL FIELD

[Industrial Application] this invention relates to the development method of developing an electrostatic latent image using the developer which does not contain the carrier particle in 2 component developer, and the so-called 1 component developer.

[Translation done.]

Drawing selection [Representative drawing]



[Translation done.]

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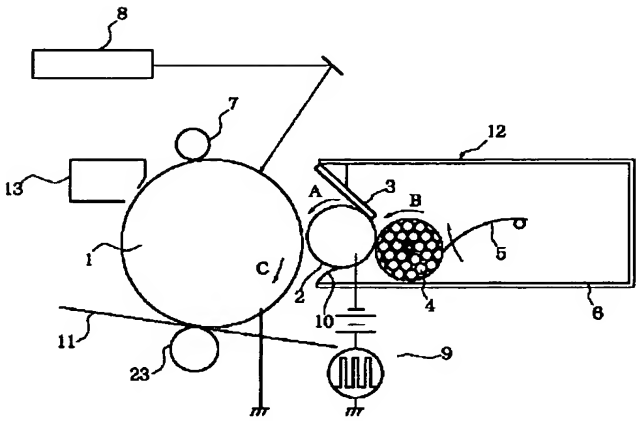
[Translation done.]

PRIOR ART

[Description of the Prior Art] When using the 1 component developer (henceforth a toner) and developing an electrostatic latent image, a toner acquires the friction charge in which development of a latent image is possible by the developing roller or friction which it is with toner thickness specification-part material further.
[0003] As for the concentration of the record picture which, on the other hand, imprints the toner image formed in the latent-image supporter to imprint material, and is acquired, 1.4 to 1.5 or more are desirable at optical density, and in order to obtain this picture concentration, it must make [many] the amount of the toner which moves onto an electrostatic latent-image support from a developing roller. Therefore, in order to obtain sufficient picture concentration conventionally, in the case of a magnetic toner, it is the toner coating weight on a developing roller Abbreviation 1.3x10-3 g/cm2 In the case of a nonmagnetic toner, it is abbreviation 0.8x10-3 g/cm2 above. It has set up above.

[Translation done.]

Drawing selection [Representativ drawing]



[Translation done.]

JAPANESE [JP,06-194943,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

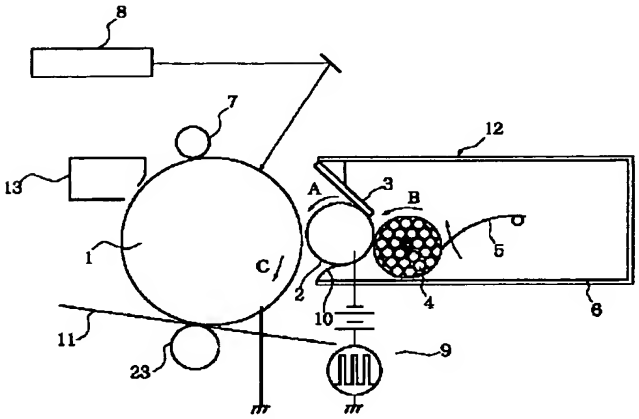
* NOTICES *

EFFECT OF THE INVENTION

[Effect of the Invention] Fogging is not generated in order to attain the concentration of sufficient picture by the above explanation according to this invention, keeping the toner layer on a development sleeve thin so that clearly.

[Translation done.]

Drawing selection [Representative drawing]



[Translation done.]

JAPANESE [JP,06-194943,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

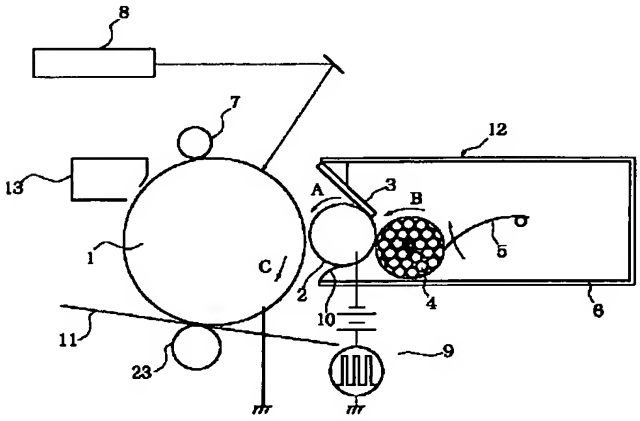
* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the toner near the center of a toner layer having un-arranged [of polarity being opposite to regular polarity, or fully not being charged], although the toner a developing roller and near the toner thickness specification-part material can be enough rubbed against these members and will fully be regularly charged, if a toner layer is set up thickly as mentioned above.
[0005] Namely, if the force of electric field in which the toner which has not been charged regularly as mentioned above arrived at the development field, and was formed of development bias is received Since it flies towards the part in which the latent image on a photoconductor drum is not formed, and it becomes fogging and the toner whose amount of electrifications is not enough exists mostly, the toner of sufficient amount for the latent-image formation section on a photoconductor drum does not reach, but there is un-arranging [that development efficiency will fall].
[0006] this invention was made in view of the above-mentioned problem, and the place made into the purpose is to offer the developer which attains a clear picture without fogging, maintaining sufficient picture concentration.

[Translation done.]

Drawing selection [Representative drawing]



[Translation done.]

JAPANESE [JP,06-194943,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

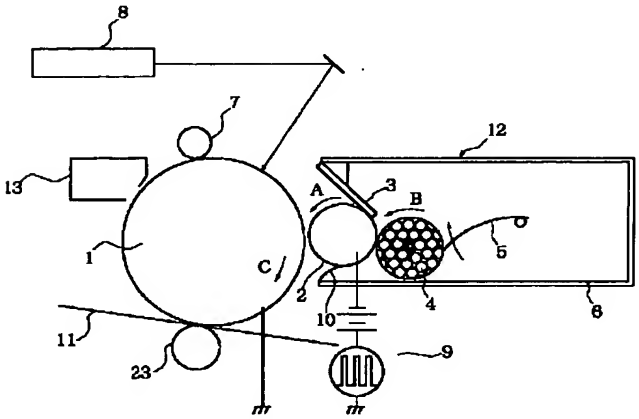
[Translation done.]

MEANS

[Means for Solving the Problem] The development sleeve which this invention kept the gap in the electrostatic latent-image support, and has been arranged that the above-mentioned purpose should be attained, The toner thin layer means forming which forms a toner thin layer in the front face of this development sleeve is provided. In the development method of going by the aforementioned gap, making the toner in the toner thin layer formed in the aforementioned development sleeve move onto an electrostatic latent-image support, and developing an electrostatic latent image When setting [the peripheral velocity of the aforementioned electrostatic latent-image support / the peripheral velocity of Vd (cm/s) and the aforementioned development sleeve] toner coating weight on rho (g/cm3) and the aforementioned development sleeve to M (g/cm2) for the density of Vs (cm/s) and a toner, It is the development method of satisfying the formula of the following 1, or 2 and 3.
[0008]
1.0.2x10-3 <= M/rho <0.4x10-3 (cm)
(M/rho) -(Vs/Vd) >=0.5x10-3 (cm)
2.0.4x10-3 <= M/rho <0.6x10-3 (cm)
(M/rho) -(Vs/Vd) >=0.7x10-3 (cm)
3.0.6x10-3 <= M/rho <=0.7x10-3 (cm)
(M/rho) -(Vs/Vd) >=0.8x10-3 (cm)

[Translation done.]

Drawing selection [Representative drawing]



[Translation done.]

JAPANESE [JP,06-194943,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

EXAMPLE

[Example] Drawing 1 is image formation equipment equipped with the developer 12 which used the nonmagnetic toner, and the front face of the electrophotography photoconductor drum 1 as an electrostatic latent-image support which ** four times in the direction of arrow C with the primary electrification vessel 7 as a printing process is uniformly charged in negative polarity. Subsequently, picture exposure is performed by the aligner 8 which uses a laser beam as the light source based on image information, and a latent image is formed on a photoconductor drum 1. Next, this latent image is formed into a visible image by reversal development with a nonmagnetic toner with a development counter 12. The toner image on a photoconductor drum 1 is imprinted on the imprint material 11, and a transfer residual toner is cleaned with a cleaner 13. It is fixed to the imprint material 11 by which the toner image was imprinted by the non-illustrated fixing assembly, and it obtains a permanent image.
[0010] a development counter 12 -- the inside of a toner bottle 6 -- toner conveyance -- the application roller 4 rotates in the direction of arrow B, and applies the nonmagnetic toner as a 1 component developer stored in the toner bottle 6 on the development sleeve 2 so that it may have the application roller 4 for conveying a toner to about two conductive development sleeve as a member 5 and a developing roller rotated in the direction of arrow A and may have relative velocity to the development sleeve 2 It is more desirable for the application roller 4 to be sponge or to give knurling tool processing or brush-like processing, in order to make this application perform good.
[0011] The applied toner is regulated by predetermined thickness with the elastic blade 3. the member in which the elastic blade 3 has elasticity, such as polyurethane rubber, -- the member of the shape of a sheet, such as polyurethane rubber, is stuck on the member which has elasticity, such as a simple substance and phosphor bronze And the pressure welding of the blade 3 is elastically carried out to the sleeve 2.
[0012] Even regulation of ** toner thickness is thinner than the minimum gap (50-500 micrometers) between a drum 1 and a sleeve 2 in the development section which develops a latent image with a blade 3. Therefore, the so-called non-contact development is performed. That is, a toner flies from a sleeve 2 and adheres to the latent image of a drum 1.
[0013] In order to improve development efficiency, the oscillating bias voltage which superimposed alternating voltage on direct current voltage from the power supply 9 is impressed to a sleeve 2, and the oscillating electric field which the sense reverses by turns are formed in the development section of this.
[0014] A toner is charged in negative polarity mainly in friction with a sleeve 2, when rubbed by the sleeve 2 with a roller 4, and when passing the nip of a blade 3 and a sleeve 2.
[0015] The result of an experiment of this example in the development counter of the above-mentioned composition is shown in Table 1. the ratio [as opposed to / in Table 1, a horizontal train is the amount M of toner support on the developer support after the toner regulation with an elastic blade (g/cm2), and / the peripheral velocity of an electrostatic

latent-image support in a column] of the peripheral velocity of a development sleeve -- it is Vs/Vd, and in this experiment, th peripheral velocity of an electrostatic latent-image support is fixed to 6.0 cm/sec., and it carries out adjustable [only of the peripheral velocity of a development sleeve] When, as for the sign of front Naka, quality of image with optical density [in the paper] practically sufficient [1.5 or more and fogging] at 1% or less is obtained for "O", when, as for concentration, fogging is a little conspicuous at 1 - 2% sufficiently but, "x" of "**" is [concentration] the case where fogging is considerably conspicuous at 2% or more, sufficiently but. Or less in 1.5, picture concentration of "U" is thin or its concentration is the case where picture concentration becomes uneven.

[0016] **** -- it set, fogging was measured using the reflection density meter TC-6DS type by Tokyo Denshoku Co., Ltd., and the value computed from the following formulas was used (Reflection factor of the imprint object before image formation) - (reflection factor of the imprint ****** picture section after image formation) (%)

[0017]

[Table 1]

表　1

M (g/cm³) / Vs／Vd	0.1 × 10^{-3}	0.2 × 10^{-3}	0.3 × 10^{-3}	0.4 × 10^{-3}	0.5 × 10^{-3}	.6 × 10^{-3}	0.7 × 10^{-3}	0.8 × 10^{-3}	1.0 × 10^{-3}
0.8							ウ		
1.0						ウ	ウ	△	
1.2				ウ	ウ	ウ	○		
1.4				○	○	○			
1.6						○			
1.8		ウ	○	○		○	○	△	×
2.0									
2.2									
2.4									
2.6	ウ	○	○			○	△	×	
2.8									
3.0		○							

[0018] Since the density rho of the nonmagnetic toner used for this example is 1.0 g/cm3, if the value of Vd, Vs, rho, and M in a setup of "O" of front Naka is substituted for the following formulas, the relation of the following formulas will be materialized in all setup.

[0019]

1.0.2x10-3 <= M/rho <0.4x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.5x10-3 (cm)

2.0.4x10-3 <= M/rho <0.6x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.7x10-3 (cm)

3.0.6x10-3 <= M/rho <=0.7x10-3 (cm)

(M/rho) -(Vs/Vd) >=0.8x10-3 (cm)

[0020] In addition, the density of a toner says the thing of the weight per unit volume in melting and the state where solidified and it considered as the solid material, on these specifications for

not a thing but the toner of a weight per unit volume of fine particles.
[0021] Next, the case where a magnetic toner is used is explained based on drawing 2 . Since the composition of the equipment except a development counter is the same as that of the image formation equipment of drawing 1 , explanation is omitted. The development counter has the container 17 which held magnetic 1 component developer 14 which does not contain a carrier particle, i.e., an insulating magnetism toner. By the nonmagnetic development sleeves 19 rotated in the direction of an arrow, such as aluminum and stainless steel, a toner is carried out from a container and conveyed by the development section 21. In the development section 21, minimum spacing was kept at 50-500 micrometers, and the electrophotography photoconductor drum 1 and the development sleeve 19 as an electrostatic latent-image support have countered. And in this development section 21, a toner is given to an electrostatic latent image and negatives are developed.
[0022] The thickness of the magnetic toner layer conveyed by the development section is regulated by the blade 16. Blades are the magnetic substance, such as iron, and have countered through the magnetic pole N1 and the development sleeve 19 of a magnet 15 by which quiescence arrangement was carried out into the development sleeve 19 in between. Therefore, the line of magnetic force from a magnetic pole N1 concentrates to a blade 16, and a magnetic curtain strong between a blade 16 and the development sleeve 19 is formed. On the development sleeve 19, the magnetic toner layer 22 thinner than the gap between a blade 16 and the development sleeve 19 is formed with this magnetic curtain.
[0023] By impressing oscillating bias voltage to a sleeve 19 from a power supply 9, the toner on a sleeve 19 is made to fly towards a drum 1, and adheres to a latent image.
[0024] A toner is charged mainly by friction with a sleeve 19.
[0025] The experimental result by the development counter of the above-mentioned composition is shown in Table 2. Since the density rho of the magnetic toner used for this example is 1.5 g/cm3, if the value of Vd, Vs, rho, and M in a setup of "O" of front Naka is substituted for the above-mentioned formula like the case of a nonmagnetic 1 component toner, the relation of the above-mentioned formula will be materialized in all setup.
[0026]
[Table 2]

表　2

Vs／Vd ＼ M (g/cm²)	0.2 × 10^{-3}	0.3 × 10^{-3}	0.4 × 10^{-3}	0.5 × 10^{-3}	0.6 × 10^{-3}	0.7 × 10^{-3}	0.8 × 10^{-3}	0.9 × 10^{-3}	1.0 × 10^{-3}	1.1 × 10^{-3}	1.2 × 10^{-3}	1.3 × 10^{-3}	1.4 × 10^{-3}	1.5 × 10^{-3}
0.8										ウ				
1.0									ウ					
1.2									○					
1.4						ウ	○	○						
1.6					ウ									
1.8			ウ	○	○			○	○	△	×			×
2.0														
2.2														
2.4														
2.6	ウ	○			○				○	×				
2.8														
3.0	ウ	○												

[0027] By the way, in order to fully electrify a toner, it is desirable to use the fluid outstanding toner.

[0028] By using a toner excellent in the fluidity, while being able to attain the formation of a uniform toner coat layer and friction charge grant on a development sleeve, in a development field, toner flight is performed good according to impression of development bias, and-izing can be carried out [a visible image] as a toner image faithful to a latent image, without forming the state where the toner particle condensed to the latent image on a photoconductor drum by the ability of formation of a uniform powder cloud to be performed.

[0029] The fluidity index in drawing 3 contains a resin and a coloring matter at least, it adheres to fluid improvement material strongly uniformly, so that this numeric value is small, and it is the index of how much fluid improvement material has adhered in homogeneity to the classification article front face which is 5-12 micrometers of volume mean particle diameters strongly, and its

fluidity improves.
[0030] Conventionally, the measuring method of a toner fluidity index took the following methods with the well-known powder circuit tester ([by Hosokawa Micron CORP.] PT-D type), and measured. Measurement environment is set to 23 degrees C and 60%RH.
[0031] After leaving a toner under measurement environment for 12 hours, weighing capacity of the 5.0g is carried out correctly. The sieve of 100 meshes (150 micrometers of openings), 200 meshes (75 micrometers of openings), and 400 meshes (38 micrometers of openings) is set to a shake table in piles from a top.
[0032] The 5.0g toner which carried out weighing capacity correctly is used calmly (on 100 meshes), and it is made to vibrate for 15 seconds with the back of 2, and the amplitude of 1mm.
[0033] The amount of toners which remained on each sieve calmly is weighed precisely.
[0034] (Amount (gof toners) which remained on 100 meshes) / 5x100 .... a(amount of toners which remained on 200 meshes (g))/5x100x3/5 .. b(amount of toners which remained on 400 meshes (g))/5x100x1/5 .. c fluidity-index (%) =a+b+c [0035] In drawing 1 , as for a setup of a development counter, and Vs, Vd and M, concentration is obtained by the experiment of drawing 3 1.5 or more, using a nonmagnetic toner, and fogging is also 1% or less.
[0036] A relation like drawing 3 is obtained from the value of the fluidity index of the toner obtained from the above-mentioned formula, and the value of fogging on a transfer paper.
[0037] Scattering of a toner becomes remarkable in using the nonmagnetic toner which cannot regulate the toner by the MAG since formation of a powder cloud is performed very actively when a toner arrives at [a fluidity index] a development field in 2% or less of field in drawing 3 especially.
[0038] If a fluidity index becomes high, the movement of a toner becomes bad at the time of the friction charge grant by the specification part, when the number of times of contact with a blade or a development sleeve becomes fewer, a toner will stop fully charging and a reversal toner will increase.
[0039] If a fluidity index exceeds 20% as shown in drawing 3 , the value of fogging will exceed 3%. For this reason, in order to acquire the high-definition picture in which fogging is not conspicuous, as for the fluidity index of the toner to be used, it is desirable that it is 20% or less.
[0040] Since it is desirable for the value of fogging in a monochrome image to be 1% or less in order to stop the total amount of fogging in the color picture formation equipment on which many especially toner images are put, the fluidity index of a toner becomes 10% or less.
[0041] However, when the fluidity index mentioned above uses for the developer which showed 20% or less of toner to drawing 1 , A toner tends to flow into the crevice between between easily. the fluidity of a toner -- each composition in the good hatchet development counter 12 -- a member -- if it is in the developer by which the big crevice was especially formed between application roller 4 edge and the toner bottle 6 wall section, without the toner which entered the crevice is supplied to the development sleeve 2 -- conveyance -- since a toner is supplied from a member 5, toner condensation will be caused
[0042] When the peripheral-speed ratio of a photoconductor drum and a development sleeve is still higher, in order to rotate at high speed, while the stress which joins a toner increases, in order to carry out the temperature rise of the application roller 4 and the development sleeve 2, the condensed toner has a possibility of carrying out ****** solidification gradually, under hot environments (room temperature of 30 degrees C or more).
[0043] As for the glass transition temperature ("Tg" is called hereafter) of this to a toner, it is desirable that it is 60 degrees C or more. Moreover, since each color toner needs to carry out ****** color mixture uniformly at the time of fixing in order to obtain a good color reproduction, when forming a color picture for cyanogen, a Magenta, yellow, and the toner image of four colors of black in piles especially and it is necessary to use the low toner of toner softening temperature, as for Tg, it is desirable that it is 67 degrees C or less.
[0044] Measurement of Tg was measured using a differential-thermal-analysis measuring device

(DSC measuring device) and DSC-7 (PerkinElmer, Inc. make). Weighing capacity of the 5-20mg of the measurement samples is carried out precisely [it is desirable and] 10mg. This is put in into an aluminum pan, and using the empty aluminum pan as a reference, the next operation is performed in order to eliminate all histories first. It is made to go up by 10 degrees C/min from a room temperature to 200 degrees C under N2 atmosphere, and maintains for 10 minutes at 200 degrees C. It quenches after that, lowers to 10 degrees C, and maintains for 10 minutes at 10 degrees C. Then, it goes up to 200 degrees C by 10 degrees C of programming rates, and min. The endothermic peak of the main peak in the range of 40-100-degree C temperature is acquired by this programming rate. Let the intersection of the middle line of the base line of the back before an endothermic peak comes out at this time, and a differential heat curve be the glass transition temperature Tg in this invention (refer to drawing 4).

[0045] By setting [in the case of monochrome image formation] up the fluidity index of a toner to 2 - 10% 2 to 20% like the above in color picture formation Furthermore, when becoming possible to prevent fogging certainly and forming a color picture using a nonmagnetic 1 component toner, by making Tg of a toner into 67 degrees C from 60 degrees C, there is no possibility that toner weld may occur under hot environments, and it becomes possible to also attain sufficient color-reproduction nature.

[0046] When the toner indicated by Japanese Patent Application No. No. 152219 [four to] in this example was used, as described above, high-definition picture also with the sufficient color reproduction at the time of fixing without fogging was acquired, and toner weld was not generated under hot environments (30 degrees C).

[0047] The binding resin of a toner with the toner which **(ed) and was indicated by the above-mentioned application The following component (a), The polyester resin generated from the monomer constituent which contains (b), (c), and (d) at least is contained as a principal component. It is the toner characterized by for the hydroxyl values of this polyester resin being 10-20, for weight average molecular weight being 13000-20000, for number average molecular weight being 5000-8000, and the ratios of weight-average-molecular-weight (Mw) / number average molecular weight (Mn) being 2-3.5.

[0048] The divalent aromatic system acid component chosen from an isophthalic acid, a terephthalic acid, and its derivative (a) 25-35-mol% of the total amount of monomers (b) The trivalent aromatic system acid component chosen from trimellitic acid and its derivative 2 - four-mol% of the total amount of monomers (c) It is 45 - 60-mol% of the total amount of monomers about 12 - 18-mol% of the total amount of monomers, the formation of (d) propoxy or/, and the etherification diphenol component that ethoxylated in the divalent acid component chosen from a dodecenyl succinic acid, an octyl succinic acid, and its anhydride at least.

[0049] Drawing 5 explains the following example. In addition, what carries out the same composition operation as the example of drawing 1 attaches the same sign, and omits explanation.

[0050] from the member in which the elastic blade 3 has elasticity, such as polyurethane rubber and phosphor bronze, in drawing 5 -- changing -- the electrification polarity of a toner -- reversed polarity -- and the member 24 of the shape of a sheet which has the property in which it is charged strongly is stuck on the toner and the portion which ****

[0051] Although nylon, cellophane, etc. which show the property of just being charged strongly as a sheet member are used in order that the toner used for this example may show negative electrification nature, the point of opposite abrasiveness and environmental stability etc. to nylon is desirable.

[0052] The amount of electrifications of the toner under each environment in the case where the blade of only polyurethane rubber and the blade which stuck the nylon sheet on the surface of polyurethane rubber are used, and the relation of quality of image are shown in Table 3.

[0053] As for a setup of a development counter, and Vs, Vd and M, concentration is obtained by the experiment of Table 3 1.5 or more like the example of drawing 1 under 23 degrees C, and

50%.environment of RH, using a nonmagnetic toner, and fogging is also 1% or less.
[0054] In performing this comparison examination, in the case of the blade of only polyurethane rubber, compared with the blade which stuck the nylon sheet, the contact pressure to the development sleeve of a blade is highly set up so that both friction may become almost equal under the environment of ordinary temperature normal relative humidity.
[0055]
[Table 3]

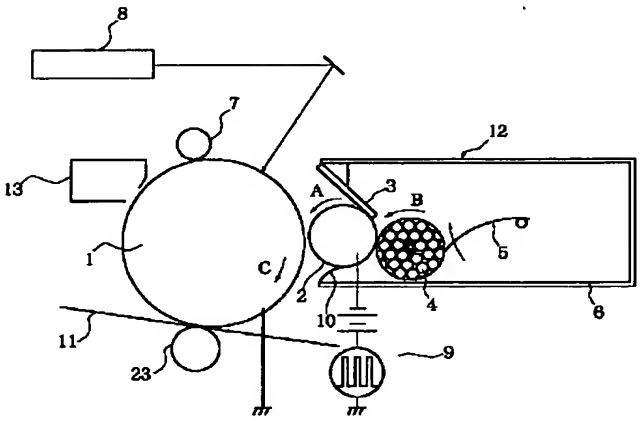
表 3

帯電量 (μC/g) / 画質	23℃ 50%R.H.	15℃ 10%R.H.	30℃ 80%R.H.
ウレタンゴムのみ	−15 / ○	−40 / 濃度不足	−6 / カブリ多し
ナイロンシート貼り付け	−18 / ○	−20 / ○	−15 / ○

[0056] Only in the case of polyurethane rubber, since the set pressure of a blade is high under low-humidity/temperature environment, a toner carries out [a blade] a charge up too much, concentration runs short, and reversal fogging has occurred under a high-humidity/temperature environment, without the ability fully giving a friction charge to a toner so that clearly from Table 3. On the other hand, when the sheet of strong positive electrification nature is used for a blade, without being influenced by environment only from polyurethane rubber, it turns out that the friction charge is certainly given to the toner, and it turns out that fogging is not generated further, either.
[0057] If it is made a setup which satisfies picture concentration and fogging under the environment of ordinary temperature normal relative humidity like an example 1 by using the sheet which carries out triboelectrification to a blade at a toner and reversed polarity as explained above, it will become possible to be stabilized under the environment of low-humidity/temperature from under the environment of heat and high humidity, and to attain high definition.

[Translation done.]

Drawing selection [Representative drawing]



[Translation done.]

JAPANESE [JP,06-194943,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

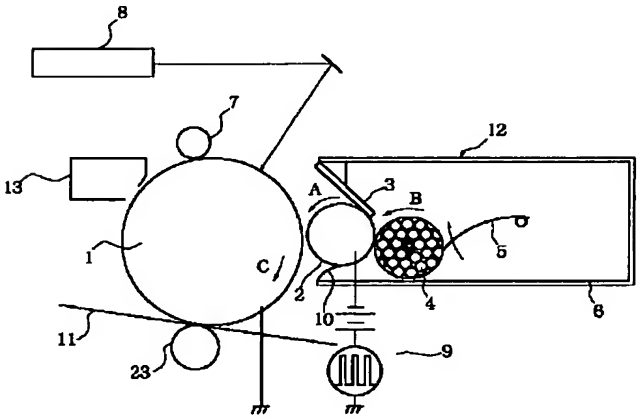
[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Explanatory drawing of one example of this invention.
[Drawing 2] Explanatory drawing of other examples of this invention.
[Drawing 3] Explanatory drawing of the relation between a fluidity index and fogging.
[Drawing 4] Explanatory drawing of Tg.
[Drawing 5] Explanatory drawing of the example of further others of this invention.
[Description of Notations]
1 Photoconductor Drum
2 Development Sleeve

[Translation done.]

Drawing selection [R presentative drawing]



[Translation done.]

JAPANESE [JP,06-194943,A]

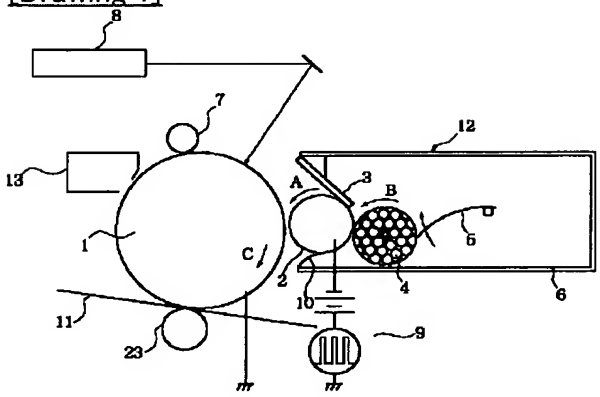
CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF DRAWINGS DRAWINGS

[Translation done.]

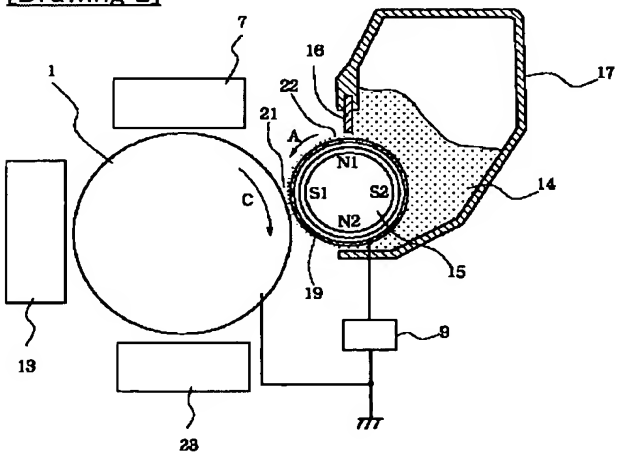
* NOTICES *

DRAWINGS

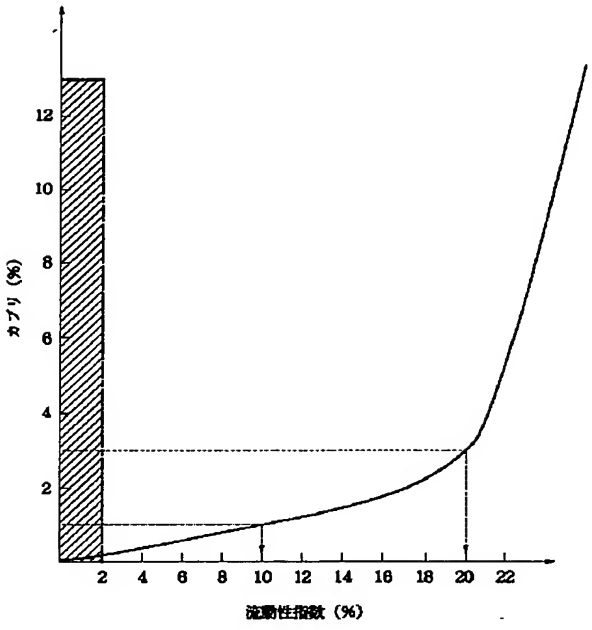
[Drawing 1]



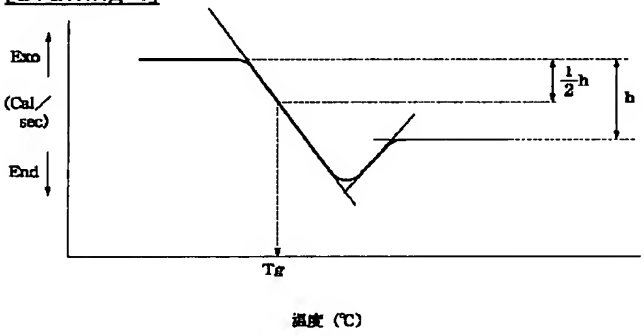
[Drawing 2]



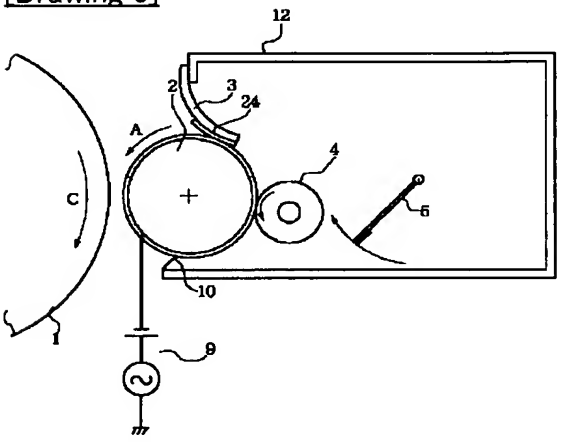
[Drawing 3]



[Drawing 4]

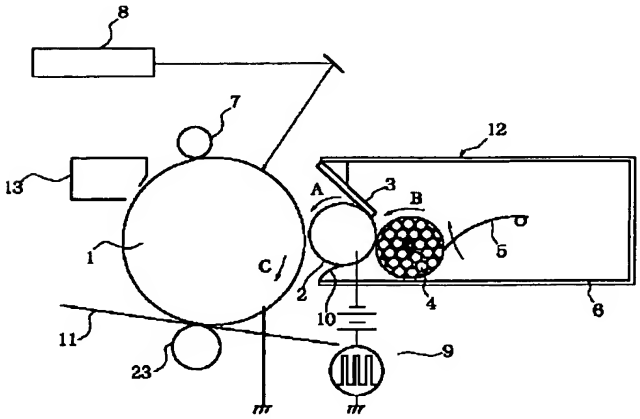


[Drawing 5]



[Translation done.]

Drawing selection [Representative drawing]



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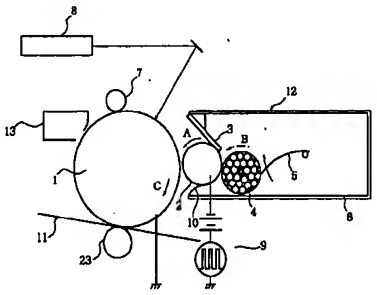
最終頁に続く

(54)【発明の名称】　現像方法

(57)【要約】

【目的】　１成分現像前により、カブリのない高濃度の画像を形成すること。

【構成】　感光ドラム１の周速をＶｄ、現像スリーブ２の周速をＶｓ、トナーの密度をρ、現像スリーブ上のトナー付着量をＭとした時、Ｍ／ρと、Ｖｓ／Ｖｄとの間に所定の関係が成立するようにする。



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【特許請求の範囲】

【請求項１】　静電潜像担持体に間隙を置いて配置された現像ローラと、この現像ローラの表面にトナー薄層を形成するトナー薄層形成手段とを具備し、前記現像ローラに形成されるトナー薄層中のトナーを前記間隙をよぎって静電潜像担持体上に移動せしめて静電潜像を顕像化する現像方法において、前記静電潜像担持体の周速度をＶｄ（ｃｍ／ｓ）、前記現像ローラの周速度をＶｓ（ｃｍ／ｓ）、トナーの密度をρ（ｇ／ｃｍ3）、前記現像ローラ上のトナー付着量をＭ（ｇ／cm^2）とするとき、下記１、２、３のいずれかの式を満足することを特徴とする現像方法。

１．０．２×10^{-3}≦Ｍ／ρ＜０．４×10^{-3}（ｃｍ）
（Ｍ／ρ）・（Ｖｓ／Ｖｄ）≧０．５×10^{-3}（ｃｍ）
２．０．４×10^{-3}≦Ｍ／ρ＜０．６×10^{-3}（ｃｍ）
（Ｍ／ρ）・（Ｖｓ／Ｖｄ）≧０．７×10^{-3}（ｃｍ）
３．０．６×10^{-3}≦Ｍ／ρ≦０．７×10^{-3}（ｃｍ）
（Ｍ／ρ）・（Ｖｓ／Ｖｄ）≧０．８×10^{-3}（ｃｍ）

【請求項２】　前記トナーの結着樹脂が、下記成分（ａ）、（ｂ）、（ｃ）、及び（ｄ）を少なくとも含有する単量体組成物から生成されたポリエステル樹脂を主成分として含有し、該ポリエステル樹脂の水酸基価が１０～２０であり、重量平均分子量が１３０００～２０００であり、数平均分子量が５０００～８０００であり、重量平均分子量（Ｍｗ）／数平均分子量（Ｍｎ）の比が２～３．５であることを特徴とする請求項１に記載の現像方法。

（ａ）イソフタル酸、テレフタル酸及びその誘導体より選ばれた２価の芳香族系酸成分を全モノマー量の２５～３５ｍｏｌ％、

（ｂ）トリメリット酸及びその誘導体より選ばれた３価の芳香族系酸成分を全モノマー量の２～４ｍｏｌ％、

（ｃ）ドデセニルコハク酸、オクチルコハク酸及びその無水物より少なくとも選ばれた２価の酸成分を全モノマー量の１２～１８ｍｏｌ％、

（ｄ）プロポキシ化、または／及びエトキシ化したエーテル化ジフェノール成分を全モノマー量の４５～６０ｍｏｌ％。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は２成分現像剤に於けるキャリア粒子を含まない現像剤、所謂一成分現像剤を使用して静電潜像を現像する現像方法に関する。

【０００２】

【従来の技術】一成分現像剤（以下トナーと言う）を用いて静電潜像を現像する場合、トナーは現像ローラ、或いは更にトナー層厚規制部材との摩擦により潜像を現像可能な摩擦電荷を得る。

【０００３】一方、潜像保持体に形成されたトナー像を転写材に転写して得られる記録画像の濃度は光学濃度で

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１．４～１．５以上が望ましく、この画像濃度を得るために現像ローラから静電潜像担持体上に移動するトナーの量を多くしなければならない。従って、従来、十分な画像濃度を得るために、現像ローラ上のトナー付着量を磁性トナーの場合約１．３×10^{-3}ｇ／cm^2以上、非磁性トナーの場合約０．８×10^{-3}ｇ／cm^2以上に設定している。

【０００４】

【発明が解決しようとする課題】しかしながら、上記のようにトナー層を厚く設定すると現像ローラやトナー層厚規制部材近傍にあるトナーはこれらの部材と十分摩擦できて正規に十分に帯電されるが、トナー層の中心付近のトナーは極性が正規極性と反対となっていたりするか、あるいは十分に帯電されないという不都合がある。

【０００５】即ち、前記のように、正規に帯電されていないトナーが現像領域に達し、現像バイアスによって形成された電界の力を受けると、感光ドラム上の潜像が形成されていない部位に向けて飛翔し、カブリとなってしまい、また、帯電量が十分でないトナーが多く存在する為、感光ドラム上の潜像形成部に十分な量のトナーが到達せず、現像効率が低下してしまうという不都合がある。

【０００６】本発明は上記問題に鑑みてなされたもので、その目的とするところは、十分な画像濃度を保ちつつ、カブリの無い鮮明な画像を達成する、現像装置を提供することにある。

【０００７】

【課題を解決するための手段】上記目的を達成すべく本発明は、静電潜像担持体に間隙を置いて配置された現像スリーブと、この現像スリーブの表面にトナー薄層を形成するトナー薄層形成手段とを具備し、前記現像スリーブに形成されるトナー薄層中のトナーを前記間隙をよぎって静電潜像担持体上に移動せしめて静電潜像を顕像化する現像方法において、前記静電潜像担持体の周速度をＶｄ（ｃｍ／ｓ）、前記現像スリーブの周速度をＶｓ（ｃｍ／ｓ）、トナーの密度をρ（ｇ／cm^3）、前記現像スリーブ上のトナー付着量をＭ（ｇ／cm^2）とするとき、下記１、２、３のいずれかの式を満足する現像方法である。

【０００８】

１．０．２×10^{-3}≦Ｍ／ρ＜０．４×10^{-3}（ｃｍ）
（Ｍ／ρ）・（Ｖｓ／Ｖｄ）≧０．５×10^{-3}（ｃｍ）
２．０．４×10^{-3}≦Ｍ／ρ＜０．６×10^{-3}（ｃｍ）
（Ｍ／ρ）・（Ｖｓ／Ｖｄ）≧０．７×10^{-3}（ｃｍ）
３．０．６×10^{-3}≦Ｍ／ρ≦０．７×10^{-3}（ｃｍ）
（Ｍ／ρ）・（Ｖｓ／Ｖｄ）≧０．８×10^{-3}（ｃｍ）

【０００９】

【実施例】図１は非磁性トナーを用いた現像装置１２を備えた画像形成装置であり、印字プロセスとしては一次帯電器７によって矢印Ｃ方向に回転する静電潜像担持体

としての電子写真感光ドラム１の表面が一様に負極性に帯電される。次いで画像情報に基づきレーザービームを光源とする露光装置８により画像露光が行われ、感光ドラム１上に潜像が形成される。次にこの潜像は現像器１２にて非磁性トナーで反転現像により可視像化される。感光ドラム１上のトナー像は転写材１１上に転写され転写残トナーはクリーナー１３でクリーニングされる。トナー像が転写された転写材１１は不図示の定着器で定着され永久像を得る。

【００１０】現像器１２はトナー容器６内にトナー搬送部材５と、矢印Ａ方向に回転する現像ローラとしての導電性の現像スリーブ２近傍にトナーを搬送するための塗布ローラ４を有し、現像スリーブ２に対して相対速度を有するよう、塗布ローラ４は矢印Ｂ方向に回転して、トナー容器６内に貯蔵された一成分現像剤としての非磁性トナーを現像スリーブ２上に塗布する。この塗布を良好に行わせるために、塗布ローラ４はスポンジであるか、ローレット加工またはブラシ状加工が施されている方が好ましい。

【００１１】塗布されたトナーは弾性ブレード３により所定の層厚に規制される。弾性ブレード３はウレタンゴム等の弾性を有する部材単体か、リン青銅等の弾性を有する部材にウレタンゴム等のシート状の部材が貼り付けてある。そしてブレード３はスリーブ２に弾性的に圧接されている。

【００１２】ブレード３で規制さえたトナー層厚は、潜像を現像する現像部に於いて、ドラム１とスリーブ２間の最小間隙（５０～５００μｍ）よりも薄い。従って所謂非接触現像が行われる。即ち、トナーはスリーブ２から飛翔してドラム１の潜像に付着する。

【００１３】現像効率を向上する為、スリーブ２には、電源９から直流電圧に交流電圧を重畳した振動バイアス電圧が印加され、これによって現像部には向きが交互に反転する振動電界が形成される。

【００１４】トナーはローラ４によりスリーブ２にこすり付けられる時、及びブレード３とスリーブ２とのニップを通過する時、主としてスリーブ２との摩擦で負極性に帯電される。

【００１５】上記構成の現像器における本実施例の実験の結果を表１に示す。表１において、横列は弾性ブレードによるトナー規制後の現像剤担持体上のトナー担持量Ｍ（ｇ／ｃｍ^2）であり、縦列は静電潜像担持体の周速度に対する現像スリーブの周速度の比Ｖｓ／Ｖｄであり、本実験では静電潜像担持体の周速度を６．０ｃｍ／ｓｅｃ．に固定し、現像スリーブの周速度のみを可変させている。表中の記号は、『○』が紙上の光学濃度が１．５以上、カブリが１％以下で実用上十分な画質が得られた場合、『△』は濃度は十分だがカブリが１～２％でやや目立つ場合、『×』は濃度は十分だがカブリが２％以上でかなり目立つ場合である。『ウ』は濃度が１．５以下で画像濃度が薄いか、画像濃度が不均一になる場合である。

【００１６】尚に於いては、カブリは東京電色社製の反射濃度計ＴＣ－６ＤＳ型を用いて測定し、以下の式より算出した値を用いた。

（画像形成前の転写体の反射率）－（画像形成後の転写体上非画像部の反射率）（％）

【００１７】

【表１】

表　1

Vs／Vd ＼ M (g/cm²)	0.1 ×10⁻³	0.2 ×10⁻³	0.3 ×10⁻³	0.4 ×10⁻³	0.5 ×10⁻³	.6 ×10⁻³	0.7 ×10⁻³	0.8 ×10⁻³	1.0 ×10⁻³
0.8							ウ		
1.0						ウ	ウ	△	
1.2				ウ	ウ	ウ	○		
1.4				○	○	○			
1.6						○			
1.8		ウ	○	○		○	○	△	×
2.0									
2.2									
2.4									
2.6	ウ	○	○			○	△	×	
2.8									
3.0		○							

【００１８】本実施例に用いた非磁性トナーの密度ρは１．０ｇ／ｃｍ^{3}であるため、表中の『○』の設定におけるＶｄ、Ｖｓ、ρ、Ｍの値を以下の式に代入すると、全ての設定において以下の式の関係が成立する。

【００１９】

１．$0.2\times10^{-3}\leq M/\rho<0.4\times10^{-3}$（ｃｍ）

$(M/\rho)\cdot(Vs/Vd)\geq0.5\times10^{-3}$（ｃｍ）

２．$0.4\times10^{-3}\leq M/\rho<0.6\times10^{-3}$（ｃｍ）

$(M/\rho)\cdot(Vs/Vd)\geq0.7\times10^{-3}$（ｃｍ）

３．$0.6\times10^{-3}\leq M/\rho\leq0.7\times10^{-3}$（ｃｍ）

$(M/\rho)\cdot(Vs/Vd)\geq0.8\times10^{-3}$（ｃｍ）

【００２０】尚、本明細書でトナーの密度というのは、粉体の単位体積当りの重量の事ではなく、トナーを溶融、固化して固型物とした状態での単位体積当りの重量の事を言う。

【００２１】次に磁性トナーを用いた場合について図２をもとに説明する。現像器を除く装置の構成は図１の画像形成装置と同様であるため説明を省略する。現像器はキャリア粒子を含まない磁性１成分現像剤、即ち絶縁性磁性トナー１４を収容した容器１７を有している。トナーは矢印方向に回転するアルミニウム、ステンレス鋼等の非磁性現像スリーブ１９によって容器から持ち出され、現像部２１に搬送される。現像部２１に於いては静電潜像担持体としての電子写真感光ドラム１と現像スリ

ープ１９は最小間隔が５０～５００μｍに保たれ対向している。そして、この現像部２１に於いて静電潜像にトナーが付与され現像される。

【００２２】現像部に搬送される磁性トナー層の厚みはブレード１６によって規制される。ブレードは鉄等の磁性体であり、現像スリーブ１９内に静止配置された磁石１５の磁極Ｎ１と現像スリーブ１９を間に介して対向している。従って、ブレード１６に対して磁極Ｎ１からの磁力線が集中し、ブレード１６と現像スリーブ１９の間に強い磁気カーテンが形成される。この磁気カーテンにより現像スリーブ１９上にはブレード１６と現像スリーブ１９の間の間隙よりも薄い磁性トナー層２２が形成される。

【００２３】スリーブ１９上のトナーは、スリーブ１９に電源９から振動バイアス電圧を印加することによりドラム１に向けて飛翔せしめられ、潜像に付着する。

【００２４】トナーは主としてスリーブ１９との摩擦により帯電する。

【００２５】上記構成の現像器による実験結果を表２に示す。本実施例に用いた磁性トナーの密度ρは１．５ｇ／ｃｍ^{3}であるため、非磁性一成分トナーの場合と同様に表中の『○』の設定におけるＶｄ、Ｖｓ、ρ、Ｍの値を上記の式に代入すると、全ての設定において上記の式の関係が成立する。

【００２６】

【表２】

表　2

Vs/Vd ＼ M (g/cm²)	0.2 ×10⁻³	0.3 ×10⁻³	0.4 ×10⁻³	0.5 ×10⁻³	0.6 ×10⁻³	0.7 ×10⁻³	0.8 ×10⁻³	0.9 ×10⁻³	1.0 ×10⁻³	1.1 ×10⁻³	1.2 ×10⁻³	1.3 ×10⁻³	1.4 ×10⁻³	1.5 ×10⁻³
0.8										ウ				
1.0									ウ					
1.2									○					
1.4						ウ	○	○						
1.6					ウ									
1.8			ウ	○	○			○	○	△	×			×
2.0														
2.2														
2.4														
2.6	ウ	○			○				○	×				
2.8														
3.0	ウ	○												

【００２７】ところで、トナーを十分に帯電させるためには、流動性の優れたトナーを用いる事が好ましい。

【００２８】流動性が優れているトナーを用いる事で、現像スリーブ上での均一なトナーコート層の形成と摩擦電荷付与が達成できると共に、現像領域において現像バイアスの印加に従いトナー飛翔が良好に行われ、均一なバウダークラウドの形成ができる事で、トナー粒子が感光ドラム上の潜像に対して凝集した状態を形成せずに潜像に忠実なトナー像として可視像化できる。

【００２９】図３に於ける流動性指数とは、少なくとも樹脂及び着色材を含有し、体積平均粒径５～１２μｍである分級品表面に流動性向上材がどの程度均一に強く付着しているかの指標であり、この数値が小さいほど流動性向上材が均一に強く付着され、流動性は向上するものである。

【００３０】トナー流動性指数の測定方法は、従来公知のパウダーテスター（ホソカワミクロン社製　ＰＴ－Ｄ型）により以下の方法を取って測定した。測定環境を２３℃、６０％ＲＨとする。

【００３１】トナーを測定環境下に１２時間放置した後、５．０ｇを正確に秤量する。振動台に、上から１００メッシュ（目開き１５０μｍ）、２００メッシュ（目開き７５μｍ）、４００メッシュ（目開き３８μｍ）のふるいを重ねてセットする。

【００３２】正確に秤量した５．０ｇのトナーを静かにふるい（１００メッシュ上）２の背、振幅１mmで１５秒間振動させる。

【００３３】静かに各ふるいの上に残ったトナー量を精秤する。

【００３４】（１００メッシュ上に残ったトナー量（ｇ））／５×１００　……ａ

（２００メッシュ上に残ったトナー量（ｇ））／５×１００×３／５　……ｂ

（４００メッシュ上に残ったトナー量（ｇ））／５×１００×１／５　……ｃ

流動性指数（％）＝ａ＋ｂ＋ｃ

【００３５】図３の実験には非磁性トナーを用い、また、現像器、Ｖｓ、Ｖｄ、Ｍの設定は図１に於いて濃度が１．５以上得られ、カブリも１％以下であったものである。

【００３６】上記の式より得られるトナーの流動性指数の値と転写紙上のカブリの値から図３のような関係が得られる。

【００３７】図３に於いて流動性指数が２％以下の領域では、トナーが現像領域に達した際に、非常に活発にバウダークラウドの形成が行われるため、特に磁気によるトナーの規制を行う事のできない非磁性トナーを用いる場合にはトナーの飛散が顕著になる。

【００３８】流動性指数が高くなると、規制部での摩擦電荷付与時にトナーの動きが悪くなり、ブレードまたは現像スリーブとの接触回数が減る事によりトナーが十分に帯電されなくなり、反転トナーが多くなる。

【００３９】図３に示すように流動性指数が２０％を越えるとカブリの値が３％を越えてしまう。このためカブリの目立たない高画質の画像を得るためには使用するトナーの流動性指数は２０％以下である事が望ましい。

【００４０】特に多数のトナー像を重ねるカラー画像形成装置に於ては、トータルのカブリ量を抑えるために単色画像でのカブリの値は１％以下である事が望ましいため、トナーの流動性指数は１０％以下となる。

【００４１】ところが、上述した流動性指数が２０％以下のトナーを図１に示した現像装置に用いた場合、トナーの流動性が良好なため現像器１２内の各構成部材間の隙間にトナーが容易に流れ込み易く、特に塗布ローラ４端部とトナー容器６内壁部間に大きな隙間が形成された現像装置にあっては、隙間に入り込んだトナーは現像スリーブ２に供給される事無く搬送部材５からトナーが供給されるためトナー凝集を招いてしまう。

【００４２】さらに感光ドラムと現像スリーブの周速比が高い場合には、塗布ローラ４、現像スリーブ２は高速で回転するためトナーに加わるストレスが増大すると共に温度上昇するため、凝集したトナーは高温環境下（室温３０℃以上）では徐々に融けて固化してしまう虞がある。

【００４３】このことからトナーのガラス転移温度（以下、「Ｔｇ」と称す）は６０℃以上である事が好ましい。また、特にシアン、マゼンタ、イエロー、ブラックの４色のトナー像を重ねてカラー画像を形成する場合、良好な色再現を得るためには定着時に各色トナーが一様に融けて混色する必要があるため、トナー軟化点の低いトナーを用いる必要があるため、Ｔｇは５７℃以下である事が好ましい。

【００４４】Ｔｇの測定は示差熱分析測定装置（ＤＳＣ測定装置）、ＤＳＣ－７（パーキンエルマー社製）を用いて測定した。測定試料は５～２０ｍｇ、好ましくは１０ｍｇを精密に秤量する。これをアルミパンの中に入れ、リファレンスとしての空アルミパンを用い、先ず全履歴を消去する目的で次の操作を行う。N_2雰囲気下で室温から２００℃まで１０℃／ｍｉｎで上昇させ２００℃で１０分間保つ。その後急冷し１０℃まで下げ、１０℃で１０分間保つ。その後、昇温速度１０℃／ｍｉｎで２００℃まで上昇する。この昇温速度で温度４０～１００℃の範囲におけるメインピークの吸熱ピークが得られる。この時吸熱ピークが出る前と後のベースラインの中間の線と示差熱曲線との交点を本発明におけるガラス転移温度Ｔｇとする（図４参照）。

【００４５】以上の如くトナーの流動性指数を単色画像形成の場合２～２０％、カラー画像形成の場合２～１０％に設定する事により、更に確実にカブリを防止する事が可能となり、また、非磁性一成分トナーを用いてカラー画像を形成する場合に、トナーのＴｇを６０℃から６７℃にする事により、高温環境下においてトナー融着の発生する虞が無く、十分な色再現性も達成する事が可能になる。

【００４６】本実施例において特願平４－１５２２１９号に記載されたトナーを用いたところ、上記したようにカブリの無い、定着時における色再現も十分な、高画質の画像が得られ、また高温環境下（３０℃）においても、トナー融着は発生しなかった。

【００４７】而して上記出願に記載されたトナーとは、トナーの結着樹脂が、下記成分（ａ）、（ｂ）、（ｃ）、及び（ｄ）を少なくとも含有する単量体組成物から生成されたポリエステル樹脂を主成分として含有し、酸ポリエステル樹脂の水酸基価が１０～２０であり、重量平均分子量が１３０００～２００００であり、数平均分子量が５０００～８０００であり、重量平均分子量（Ｍｗ）／数平均分子量（Ｍｎ）の比が２～３．５であることを特徴とするトナーである。

【００４８】（ａ）イソフタル酸、テレフタル酸及びその誘導体より選ばれた２価の芳香族系酸成分を全モノマー量の２５～３５ｍｏｌ％、（ｂ）トリメリット酸及びその誘導体より選ばれた３価の芳香族系酸成分を全モノマー量の２～４ｍｏｌ％、（ｃ）ドデセニルコハク酸、オクチルコハク酸及びその無水物より少なくとも選ばれた２価の酸成分を全モノマー量の１２～１８ｍｏｌ％、（ｄ）プロポキシ化、または／及びエトキシ化したエーテル化ジフェノール成分を全モノマー量の４５～６０ｍｏｌ％。

【００４９】次の実施例について図５により説明する。尚図１の実施例と同様の構成作用をするものは、同一の符号を付し説明を省略する。

【００５０】図５に於いて弾性ブレード３は、ウレタンゴム、リン青銅等の弾性を有する部材から成り、トナーの帯電極性とは逆極性に且つ強く帯電する性質を有するシート状の部材２４がトナーと摺擦する部分に貼り付けてある。

【００５１】本実施例に用いたトナーは負帯電性を示すため、シート部材としては強く正に帯電する特性を示すナイロン、セロファン等を用いるが、対摩耗性、環境安定性の点等からナイロンが好ましい。

＊【００５２】表３にウレタンゴムのみのブレードと、ナイロンシートをウレタンゴムの表層に貼り付けたブレードを用いた場合での、各環境下に於けるトナーの帯電量と画質の関係を示す。

【００５３】表３の実験には非磁性トナーを用い、また、２３℃、５０％ＲＨの環境下に於いて、現像器、Ｖｓ、Ｖｄ、Ｍの設定は図１の実施例と同様に濃度が１．５以上得られ、カブリも１％以下であったものである。

【００５４】この比較検討を行うにあたり、常温常湿の環境下で両者の摩擦がほぼ等しくなるように、ウレタンゴムのみのブレードの場合、ナイロンシートを貼り付けたブレードに比べブレードの現像スリーブに対する当接圧を高く設定してある。

【００５５】

【表３】

＊表　3

帯電量（μC/g） ＼ 画質	23℃ 50％R.H.	15℃ 10％R.H.	30℃ 80％R.H.
ウレタンゴムのみ	－15 ○	－40 濃度不足	－6 カブリ多し
ナイロンシート貼り付け	－18 ○	－20 ○	－15 ○

【００５６】表３から明らかなように、ブレードがウレタンゴムのみの場合は、低温低湿環境下ではブレードの設定圧が高いためにトナーが過度にチャージアップし、濃度が不足しており、高温高湿環境下ではトナーに十分に摩擦電荷を与える事ができずに、反転カブリが発生している。一方、ブレードに強ポジ帯電性のシートを用いた場合、ウレタンゴムのみよりも環境に左右されずに、確実にトナーに摩擦電荷が与えられている事がわかり、さらにカブリも発生しない事がわかる。

【００５７】以上説明したように、ブレードにトナーと逆極性に摩擦帯電するシートを用いる事により、実施例１の如く常温常湿の環境下で画像濃度とカブリを満足する設定にすれば、高温多湿の環境下から低温低湿の環境下まで安定して高画質を達成する事が可能になる。

【００５８】

【発明の効果】以上の説明で明らかな如く本発明によれば、現像スリーブ上のトナー層を薄く保ったまま十分な画像の濃度を達成するためカブリを発生する事がない。

【図面の簡単な説明】

【図１】本発明の一実施例の説明図。

【図２】本発明の他の実施例の説明図。

【図３】流動性指数とカブリの関係の説明図。

【図４】Ｔｇの説明図。

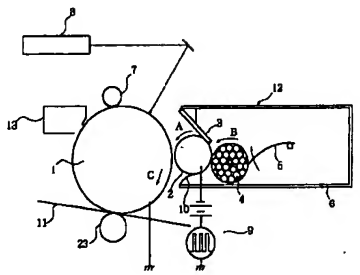
【図５】本発明の更に他の実施例の説明図。

【符号の説明】

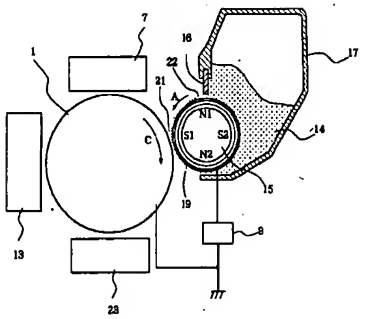
１　感光ドラム

２　現像スリーブ

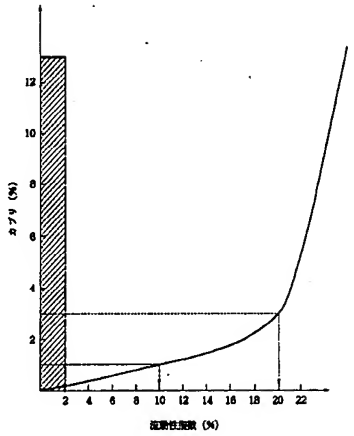
【図１】



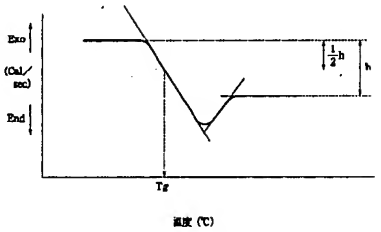
【図２】



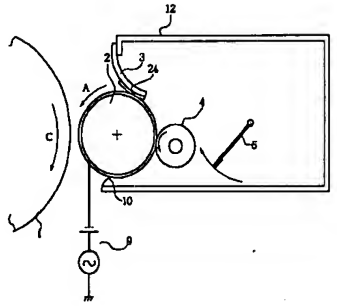
【図３】



【図４】



【図５】



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